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Cleft Lip and Palate Patient Rhinoplasty

Angelo Cuzalina and Ahmed Tamim

Abstract

Cleft lip and palate patients represent one of the most difficult groups of patients for septorhinoplasty. Prior surgery at younger ages resulting in severe scar tissue is a major obstacle in most cleft rhinoplasties along with substantial asymmetries especially in the unilateral cleft patient. Replacement of missing and asymmetric cartilages and even bone is a key component for rhinoplasty in the cleft patient. Use of very sturdy cartilage typically from rib is almost always required to adequately resist the fibrotic soft tissues in the noses. Plus, rib cartilage can be carved into ideal septal extension and batten grafts that are required.

Keywords: rhinoplasty, nose job, cleft palate, reconstruction, rib grafting, septal extension graft, batten graft

1. Introduction

Rhinoplasty is one of the complex surgical procedures as it deals with skin, cartilage and bone, and all of that is done in the middle of the face, which makes it very noticeable and less forgiving. Now, to do the procedure on a cleft lip and palate patient is twice as hard, since you must contend with asymmetry, deficient bone and soft tissue [1]. Primary and secondary cleft rhinoplasty may be necessary to achieve optimal esthetic results for patients. This chapter focuses mainly on the secondary or definitive rhinoplasty reconstructive surgery to repair CLP and new techniques stressing the importance of robust septal extension grafts and batten grafts along with a novel method of placement.

2. Anatomy

2.1 Nasal deformity associated with unilateral cleft defect

The interrupted insertion of orbicularis oris muscle into the columella on the noncleft side forces the premaxilla, columella and caudal nasal septum towards that side [2, 3]. At the same time, as the orbicularis oris inserts into the alar base on the cleft side, the base is pulled laterally, inferiorly and posteriorly [2, 3]. The malformed lower lateral cartilage on the side of the cleft contributes majorly to the deformity of the nasal tip, causing it to be more blunt [2] (**Figure 1**). A shorter medial crus and a longer lateral crus on the cleft side results in a horizontally wider and displaced nostril on the cleft side [2, 3] (**Figure 2**).

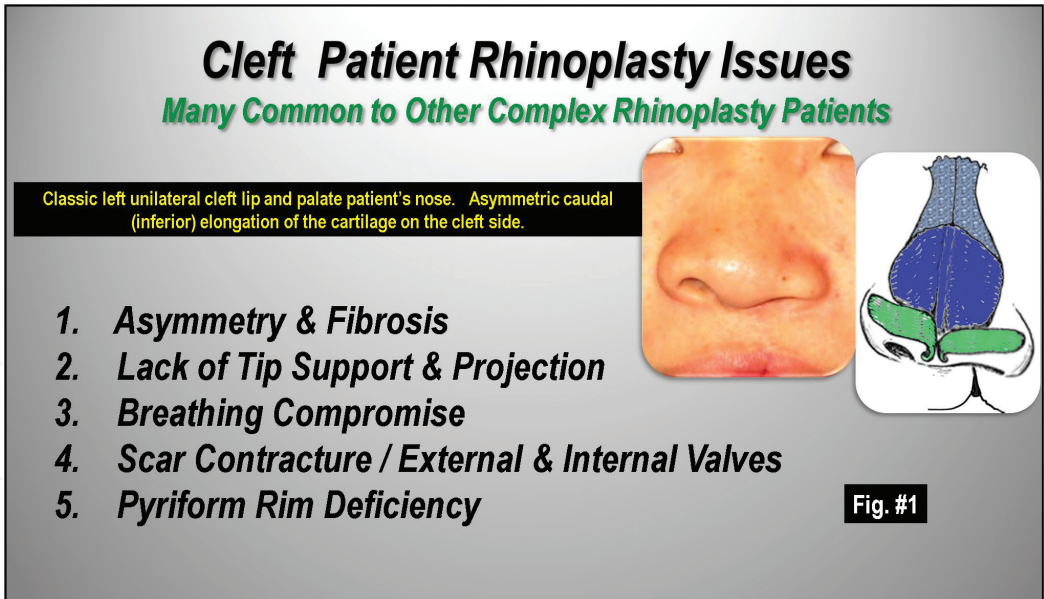


Figure 1.
Typical cleft lip and palate nasal issues are listed. Typically, a malformed lower lateral cartilage exists on the side of the cleft that contributes to the deformity of the nasal tip, causing it to be more flat and blunt.

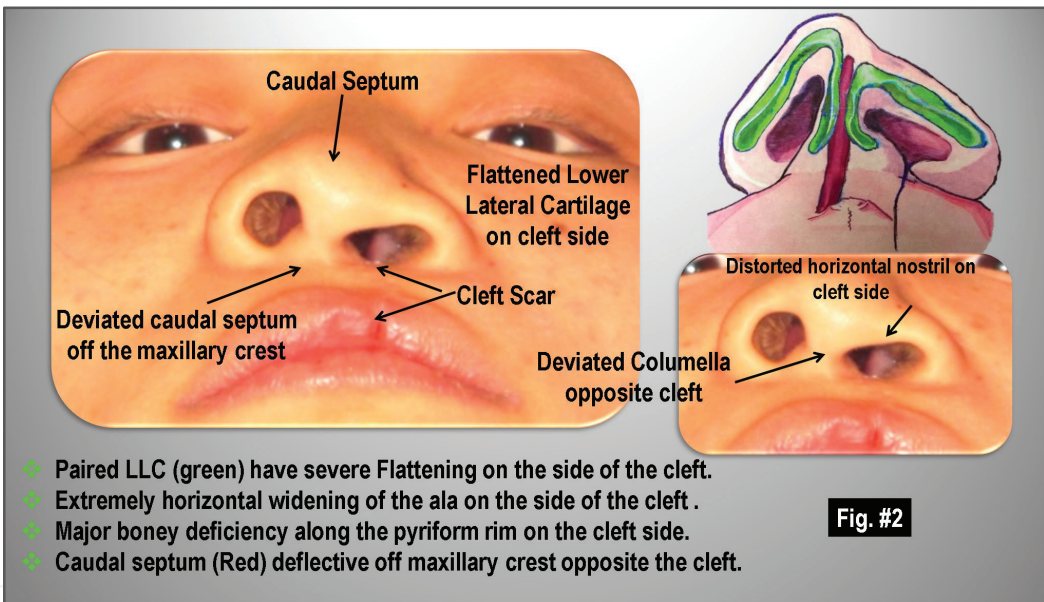


Figure 2.
A shorter medial crus and a longer lateral crus exist on the cleft side resulting in a horizontally wider and displaced nostril on the cleft side. The deficient pyriform rim bone can also be seen on the cleft side.

It is also worth noting that while the caudal septum is forced towards the noncleft side, the rest of the septum is deviated towards the cleft side. This septal bowing, along with decreased nasal aperture, causes nasal air obstruction.

Moreover, internal vestibular webbing is evident on the cleft side causing the nostril margin on that side to buckle inwardly [3].

Also, the lower lateral cartilage is introverted which causes further nasal obstruction by narrowing the external nasal valve and makes the nasal ala look thicker and hooded [2]. The introversion of the lower lateral cartilage, secondary to the pressure from the abnormal position of the alar base, and columella which push the cartilage down and back [4] (**Figure 3**). The asymmetries of the LLC and Septum requires a specific treatment most commonly involving asymmetric lateral crural steal techniques fixated to a septal extension graft (**Figures 4 and 5**).

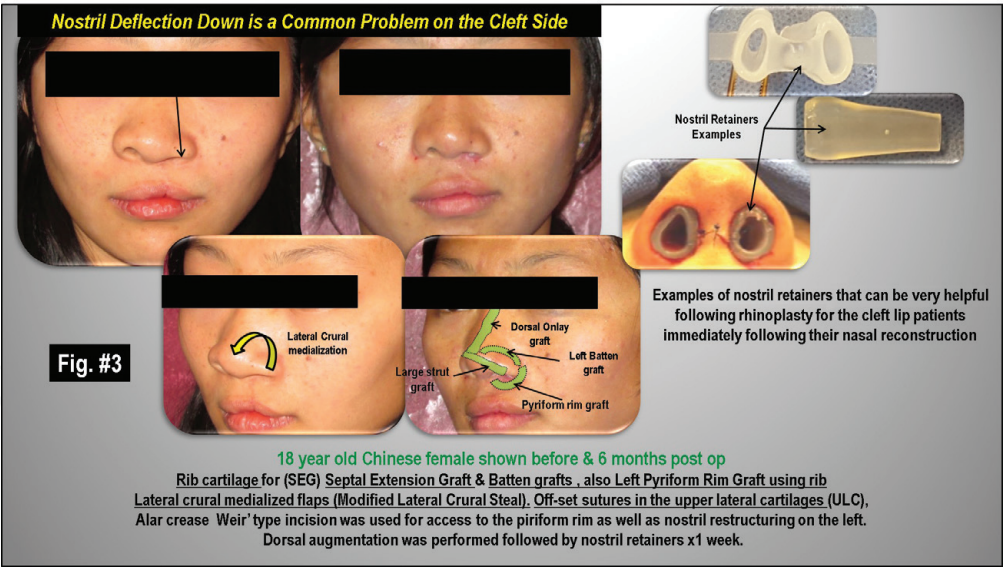


Figure 3.
Before and 6 months after classic rhinoplasty surgery to improve the patient's nose who has a left cleft lip and palate. Multiple grafts are required, particularly septal extension, batten, and pyriform rim grafts.

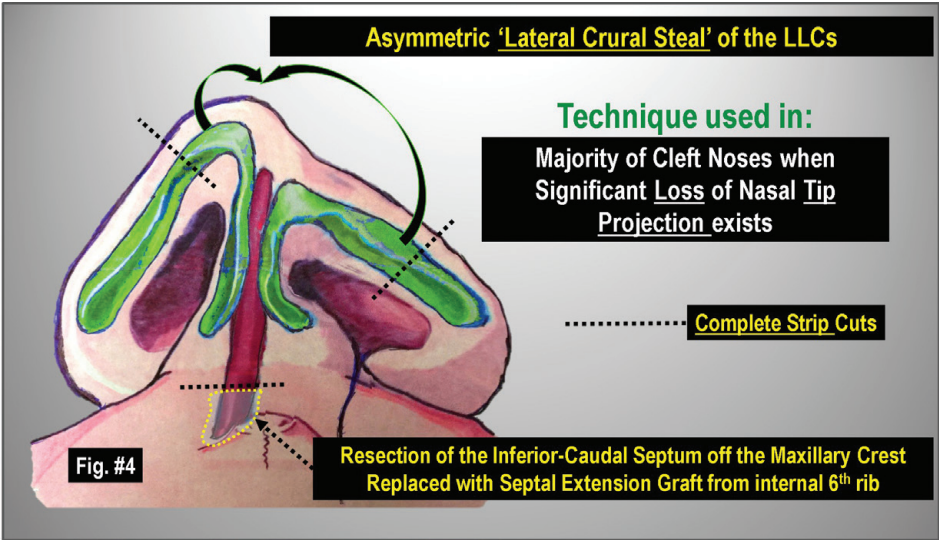


Figure 4.
The asymmetric of the LLC and septum requires a specific treatment shown involving an asymmetric lateral crural steal rotation cartilage flaps fixated to a septal extension graft.

2.2 Nasal deformity associated with bilateral cleft defect

Bilateral and unilateral nasal cleft deformities are similar and share many characteristics [3]. However, bilateral nasal cleft defects tend to be symmetrical [2]. The shortness, or in some cases, the absence of the columella is caused by soft tissue deficiency between the nasal tip and upper lip [2] (**Figure 6**).

Absence of nasal floor with bilateral hypoplastic maxilla is another key feature of bilateral nasal cleft deformity [3]. The alar base is wide and positioned caudally, laterally and inferiorly, with less defined nasal tip due to the longer lateral crus and shorted medial crus of the lower lateral cartilage on cleft side [2, 3]. Vestibular webbing is seen bilaterally [3].

The septum is typically straight in the midline due to the symmetry. However, in some cases where there is asymmetry, the less affected side applies more force to the caudal septum pulling it towards that side [2, 3].

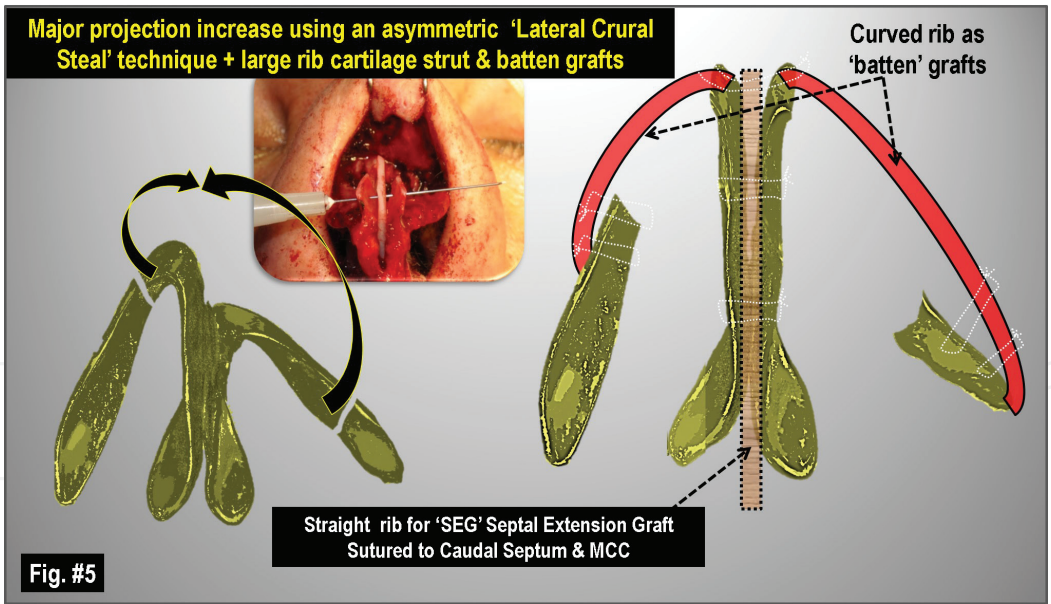


Figure 5. Diagrams show the attachment of the asymmetric rotation of the lower lateral cartilage flaps to both large septal extension graft and as curved batten graft for recreation of normal lower nose architecture.

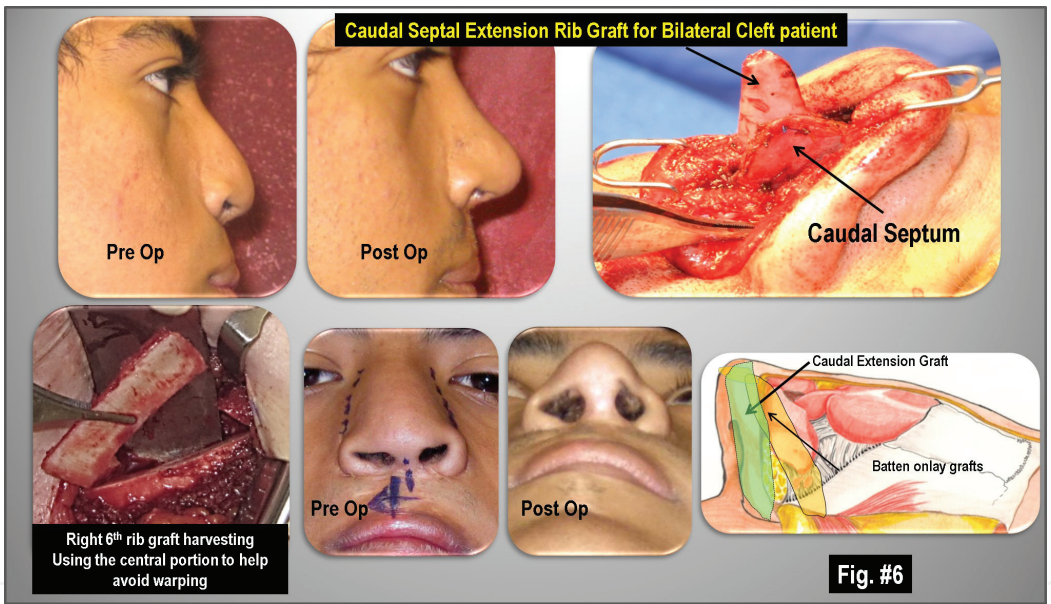


Figure 6. A short columella is caused by soft tissue deficiency between the nasal tip and upper lip, especially in some bilateral cleft cases as shown. Large and strong septal extension grafts from rib are particularly important for these cases.

2.3 Surgical timing

Surgical nasal deformity repair is normally done in multiple stages, divided based on surgical timing: primary, intermediate, and secondary. Primary rhinoplasty is performed at the time of cleft lip repair [4–6]. The typical age of cleft lip repair is 2–3 months old [4, 7]. However, current mainstream surgical timing remains around 3 months of age to avoid higher risk of complications, especially during anesthesia [7].

Intermediate rhinoplasty is performed at age 5–11 years old, typically between 4 and 6 years old before patients attend school [2, 5]. And lastly, secondary or definitive rhinoplasty is generally undergone after completion of facial growth, which differs based on gender [2]. For females it is usually 14–16 years of age, while males

it is later at 16–18 years of age [2]. However, there are other factors that can contribute to the timing of the definitive rhinoplasty, including: patient's size, extent of deformity, and situations may warrant definitive rhinoplasty as early as age 10–12 in limited situations [6].

2.4 Primary rhinoplasty

Rhinoplasty performed at this stage is currently considered by many surgeons as the accepted surgical treatment [4]. It is even considered the standard of care in the United States amongst other countries [8]. The original notion that primary rhinoplasty can interfere with facial growth has been disputed by many recent studies [2].

The primary target of this surgery is to obtain a symmetrical nasal tip and alar base [4]. There are many described techniques to correct the asymmetrical unilateral nasal deformity, including V-Y-Z plasty [2, 9]. In general, the lower lateral cartilage is released and repositioned [2–4, 6]. The alar base is separated from the pyriform aperture and maxilla to be repositioned symmetrically [4, 6]. Nasal tip plasty is performed to enhance its projection [4]. Moreover, caudal nasal septum is repaired at this stage by attaching it to the anterior nasal spine [2]. The usage of presurgical nasoalveolar molding (NAM) device can be successful in shaping nasal cartilage within the first 6 weeks after birth, when the cartilage is more elastic due to high levels of circulating maternal estrogen [10].

2.5 Intermediate rhinoplasty

This surgery is only performed when needed. Some bilateral cleft nasal deformity patients undergo surgery at this stage to correct severely asymmetrical nasal tip that was not repaired in primary rhinoplasty [2, 6]. It also aims at lengthening shortened columella [6]. For unilateral nasal deformities, it addresses any residual defects in lower lateral cartilage and lateral vestibular webbing.

Septal repositioning and cartilage grafting are not done at this stage; they are postponed until complete skeletal growth is achieved in adulthood [2].

2.6 Secondary/definitive

It is usually needed to correct secondary deformities and scarring developing after primary cleft lip and nose repair. The success of primary rhinoplasty and the severity of secondary deformities are dependent on surgeon's skill and experience [8].

Open approach is the most common technique used in definitive rhinoplasty, as it allows for enhanced exposure of muscle structure, cartilage, vestibular lining, and dense scarring [2, 4, 6]. It also aids in precise positioning of lateral lower cartilage, nasal base, and septum, as well as accurate grafting and suturing [6].

Goals of definitive rhinoplasty include: nasal and tip definition, removal of scar and fibrofatty tissue, and nasal obstruction repair [4, 6] (**Figure 7**). In some cases, depending on the complexity of the cleft lip and palate deformity, Le Forte maybe needed to correct secondary maxillary hypoplasia [11]. Definitive rhinoplasty is typically performed after repairing major skeletal defects with necessary orthognathic surgery [3].

2.7 Incision

Secondary cleft rhinoplasty is almost always performed via an open approach, giving access to different parts of the nose that needs reconstruction along with direct visualization. The usual incision is infracartilaginous and V or W shaped transcolumellar. Keep in mind that the medial crura are right under the skin in

the lateral portion of the columella, so a superficial dissection is indicated at this area [2]. Once the skin flap is elevated, the cartilage and bone components can be examined thoroughly.

2.8 Septum

Deviated septum in cleft patients causes airway obstruction by causing physical stenosis and turbulent airflow [12]. Correcting the septum involves dissecting its cartilaginous and bony parts, including the vomer and perpendicular plate of the ethmoid bone (PPE) [12]. However, it is best to maintain at least 1-cm width of dorsal and caudal septal segments, or L-strut, to preserve the tip and dorsal nasal support [2]. There should also be more than 40% fixation area, or contact point, between nasal crest of maxilla and L-strut when dissecting caudal septum [2]. This decreases the strain energy and stress values on septum, and relieves excessive load forces on L-strut, which lessens the chances of future nasal deformities, including collapse of dorsal septum or saddle deformity, and nasal tip ptosis [2]. However, in some cases, the septal deviation is severe enough that the dissection of the deviated segment and its replacement with a straight graft becomes necessary. The graft is obtained from septal cartilage, or the rib cartilage maybe used if a larger segment is needed [13]. Sutures through the upper lateral cartilages and septum are placed to apply force in the opposite direction of the L-strut deviation, and thus correcting it and creating symmetry [14].

In certain cases, a notch is made in the nasal spine using a straight osteotome to allow for a stronger attachment of the caudal strut [15].

Spreader grafts and batten onlay grafts can be harvested from the resected parts of the quadrangular septal cartilage, but most often from the curved portion of the right sixth rib in order to have adequate shape, size and strength of cartilage required in the cleft rhinoplasty [3] (**Figure 8**). For instance, curved batten grafts are sutured to the lower lateral cartilage and strut to take the natural convex form of the external nasal valve and support it [3].

The transcolumellar open incision is the most common access technique in definitive rhinoplasty as it provides better exposure of the septal cartilage [16]. The incision is made anterior to the footplate segments of the medial crura of the lower lateral cartilage [16]. A mucoperichondrial flap is raised with caution not to perforate the surrounding mucosa to allow excellent coverage of a large SEG from rib [3].

2.9 Spreader graft

Spreader grafts are used to open up the internal nasal valve, mainly the middle third of the nose and improve the breathing [3, 12]. They are usually obtained from either the nasal septal cartilage or part of the harvested rib cartilage. They are placed between the septum and upper lateral cartilage bilaterally and secured with sutures [12]. If needed, the spreader graft can extend more caudally and act as a strut graft for better nasal tip support and it also helps with the septum stability and straightening. Spreader grafts can sometimes be used to correct severe septal deviation, by placing the grafts along the dorsal septum, while reattaching the caudal strut to the nasal spine between the medial crura by suture fixation [17–21].

2.10 Nasal and dorsum osteotomies

The nasal dorsum in cleft patient is usually deficient and flat and an easy way to address that is applying a silicone implant or using a dorsal onlay graft from rib (**Figure 9**). Septum and nasal bones usually deviate towards the non-cleft side, as

the root of the nasal dorsum is deviated towards the cleft site [2]. If a dorsal hump existed, reduction of the bone by rasping and cartilage by either no. 15 blade or a scissor will be needed. Usually after the reduction, patient will develop an open roof deformity and to treat that, a lateral nasal osteotomy is required to narrow the width. A small 2–3 mm osteotome is utilized to create micro punctures along the planned cut and the osteotome is inserted percutaneous or preferably transnasally and usually the osteotomies are done low to high [2] (Figure 10).

2.11 Nasal tip, lower lateral cartilage and sturdy batten grafts

The lower lateral cartilage on the cleft side is usually collapsed vertically and displaced inferiorly. And to address and correct the lower lateral cartilages, an open

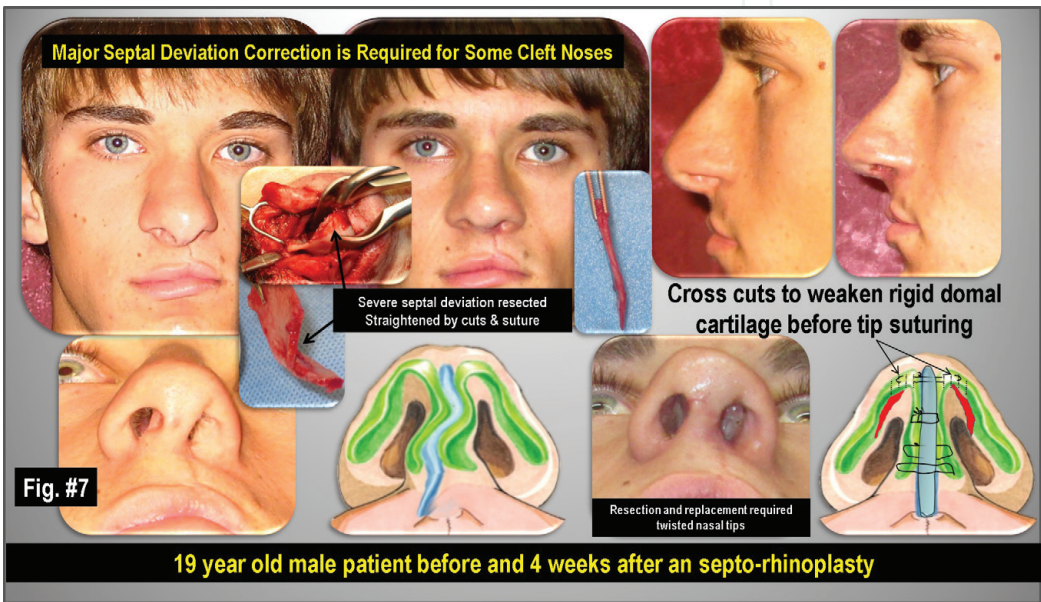


Figure 7.
This figure demonstrates the importance of septal extension grafts to correct major tip and caudal septal deviation in cleft patients. The severely deviated cartilage often must be completely removed and replaced with new grafted cartilage.

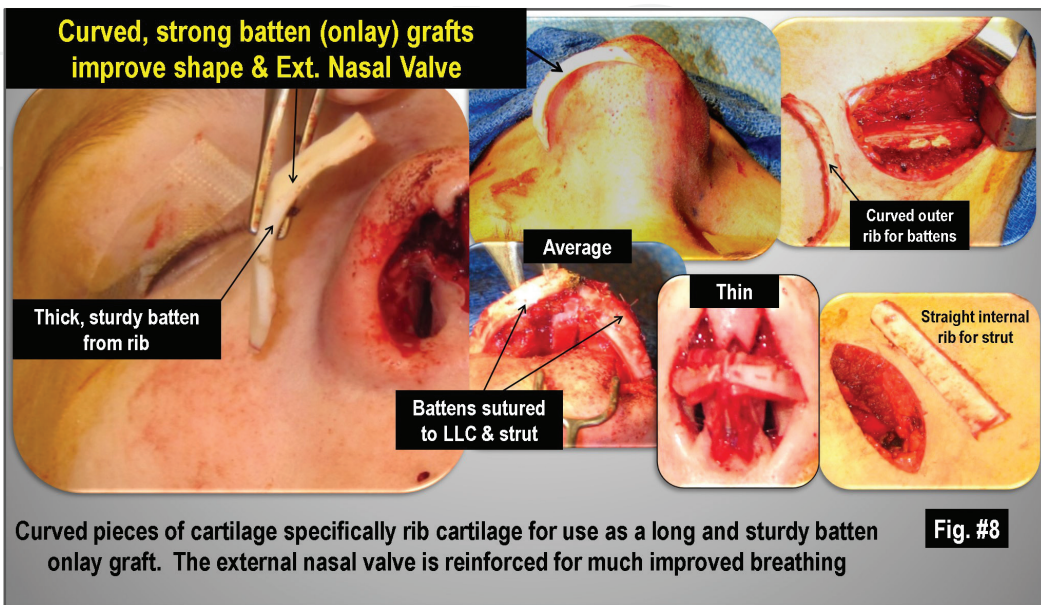


Figure 8.
Curved batten onlay grafts are demonstrated. Spreader grafts and batten onlay grafts can be harvested from the resected parts of the quadrangular septal cartilage, but most often from the curved portion of the right sixth rib.

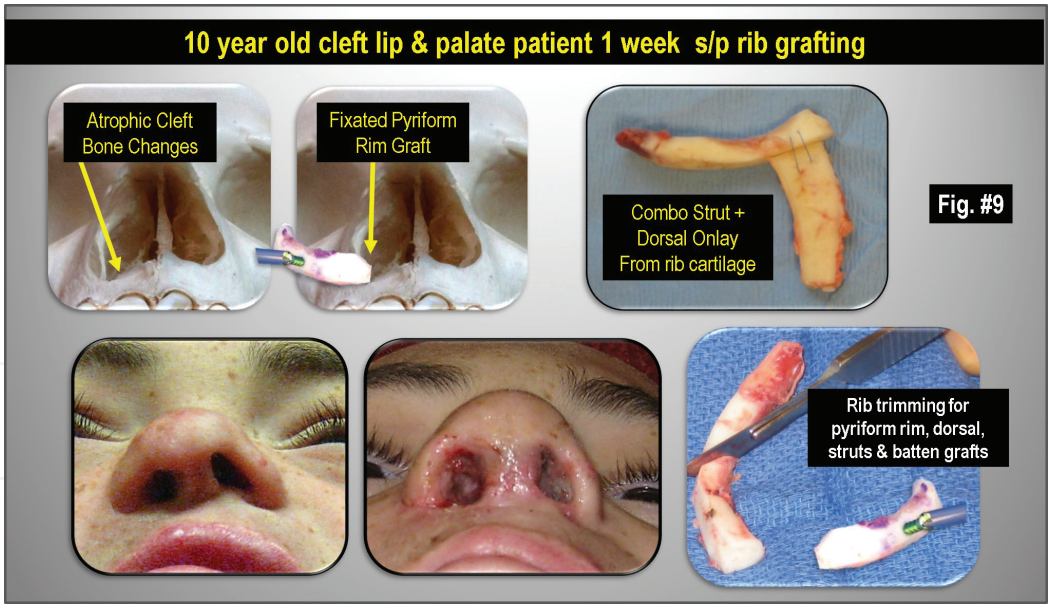


Figure 9.
A deficient and flat nasal dorsum in a cleft patient can be addressed by using a dorsal onlay graft from rib as demonstrated. The same rib can also be used for augmentation of the deficient pyriform rim.



Figure 10.
A small 2–3 mm osteotome is utilized to create micropunctures along the planned osteotomies as shown. The cleft patient may still require dorsal grafting along with the osteotomies in some cases.

rhinoplasty incision is utilized, cephalic trimming of the cartilage is performed if LLC are too large, making sure to leave at least 5 mm for support. Next, the septum can be accessed through transdomal dissection and then repair the septum and harvest cartilage, if no rib cartilage harvest is planned/needed; a caudal septum extension graft is placed and secured to the lower lateral cartilage and the septum, which will improve the nasal tip projection and support (**Figure 11**). The graft should be slightly behind the medial crura, otherwise the columella can look too wide or simply feel too firm to the patient [13]. Extra strengthening of the nasal base can be done by applying mattress sutures holding the medial crural cartilage to the septum and positioning the tip in a more cephalic location [13]. To achieve better symmetry to the nasal tip, a lateral crural steal or advancement flap is used [3] (**Figures 4 and 5**). Where a longer part of the lateral crus on the cleft side is cut and a shorter part of the lateral crus on the non-cleft side is cut as the cleft side lateral crus cartilage is longer horizontally and

shorter vertically at the medial crus than the non-cleft side and that will allow for more symmetry and tip projection. Then a rib cartilage graft is used to reconstruct bilateral lower lateral cartilage crus which can be placed as a batten only or below the remaining lateral crus. Long, strong batten grafts are often a critical component to success especially if alar retraction exist (**Figure 12**). If further tip projection is needed, a shield graft can be utilized. For a good tip support, the caudal septum extension graft needs to extend past the septum for a minimum of 4–5 mm with a thickness of at least 1 mm. The cartilage harvested from the septum can be used for that or if more needed a rib cartilage can be used, which is more common in for the cleft rhinoplasty cases as the thickness of the cartilage provide enough resistance to hold the post inflammatory changes, besides most of the time there will be multiple areas of deficiencies to be addressed and the septal cartilage would not be enough to cover all of them.

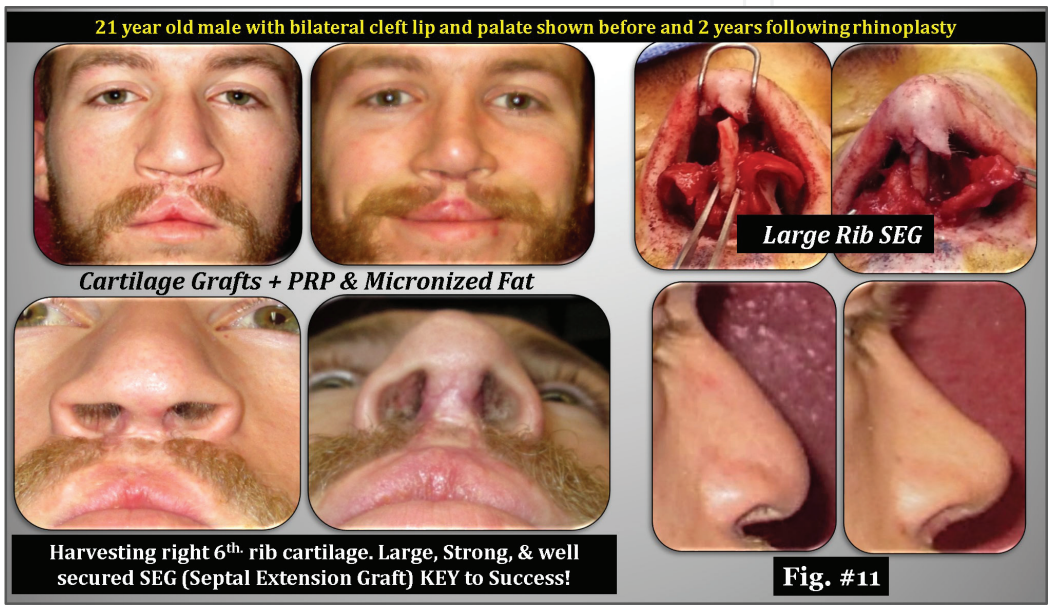


Figure 11.
The septum is accessed and shown via a transdomal dissection followed by placement of a caudal septum extension secured to the lower lateral cartilage and the septum. This dramatically improves the nasal tip projection and support.

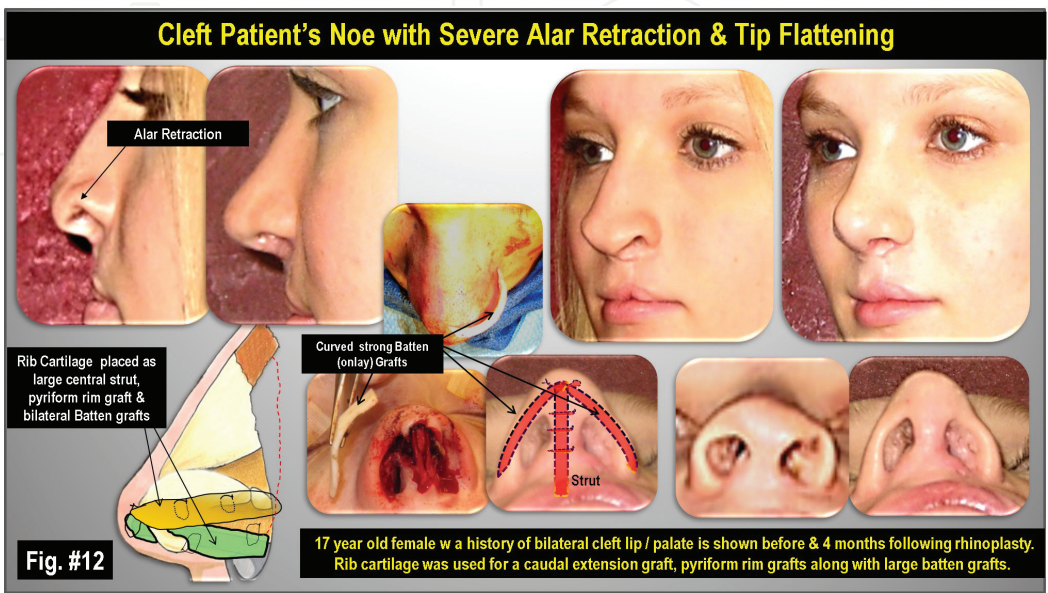


Figure 12.
Long, strong batten grafts often are a critical component to success and demonstrated in this figure. They are especially useful if alar retraction exists prior to the rhinoplasty.

2.12 Piriform rim and premaxilla augmentation

Cleft lip and palate patients will have piriform rim deficiency, which leads to inferior and posterior displacement of the nose at the side of the cleft, and if left unaddressed will lead to asymmetric results, even if all the other aspects of the rhinoplasty were well addressed [3]. Part of the rib graft can be used and stacked for augmentation and secured with a screw, other options are silicone implant, cortical bone or fat grafting [2] (**Figure 9**).

2.13 Alar base reduction

The last portion of the rhinoplasty is to address the alar base. Usually it is inferiorly and laterally displaced (**Figure 13**). To fix the asymmetry V-Y advancement or the weir procedure (alar resection) are utilized at the alar facial groove [3]. The weir procedure is generally used when there is lateral skin excess and also that will provide an access to the piriform rim for augmentation (**Figure 14**). It is recommended to use nostril retainer to help shape the nasal sill. Skin grafting or composite grafting just inside the ala is performed when enlargement of the nostril size is required to improve symmetry (**Figure 15**).

2.14 Rib cartilage

Compared to autologous tissue, alloplastic implants carry higher risk of infection and dehiscence. Rib cartilage is the source of choice in patients who need larger sturdy grafts to repair severe deformities of nasal tip projection and provide strong support. Its main advantages include its availability in large quantities if needed, resistance of scar contracture, strength, and versatility. Donor site morbidity is one of its main disadvantages, including post-surgical pain, scarring, and risk of pneumothorax. In some cases, especially in older populations, rib cartilage graft can ossify. In other cases, graft warping has been documented [3]. The graft is typically harvested from the sixth or seventh rib, usually the right side.

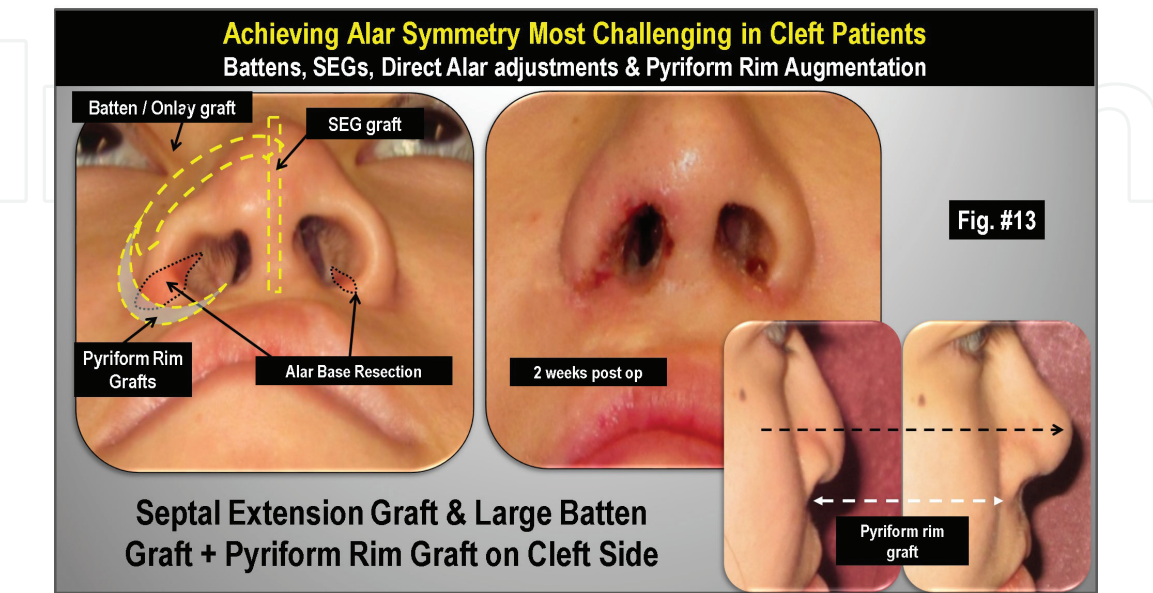


Figure 13.
The last portion of the rhinoplasty addressed is the alar base shown. The base on the cleft side is often inferiorly and laterally displaced. The weir procedure is generally used when there is lateral skin excess and provides an access to the piriform rim for augmentation.

Incision is made with a 10 blade, and electrocautery is used for dissection through subcutaneous tissue and muscle to access the rib, and then incise through the perichondrium.

The subperichondral dissection extends from the junction of the sternum and cartilage to the osseocartilaginous junction, and is carried posteriorly. To protect the perichondrium, it is best to place a retractor posterior to the rib. It is worth noting that full rib resection or discontinuous harvesting should be avoided to decrease post-op complications. The middle portion of rim is used for the SEG to avoid warp-age and soaked in sterile saline for 1 h prior to placement. In some severe deformities where a large graft is needed, harvesting cartilage from more than one rib maybe indicated. After wound irrigation and obtaining hemostasis, it is imperative to rule out pneumothorax by filling donor site with saline and having anesthesia provider

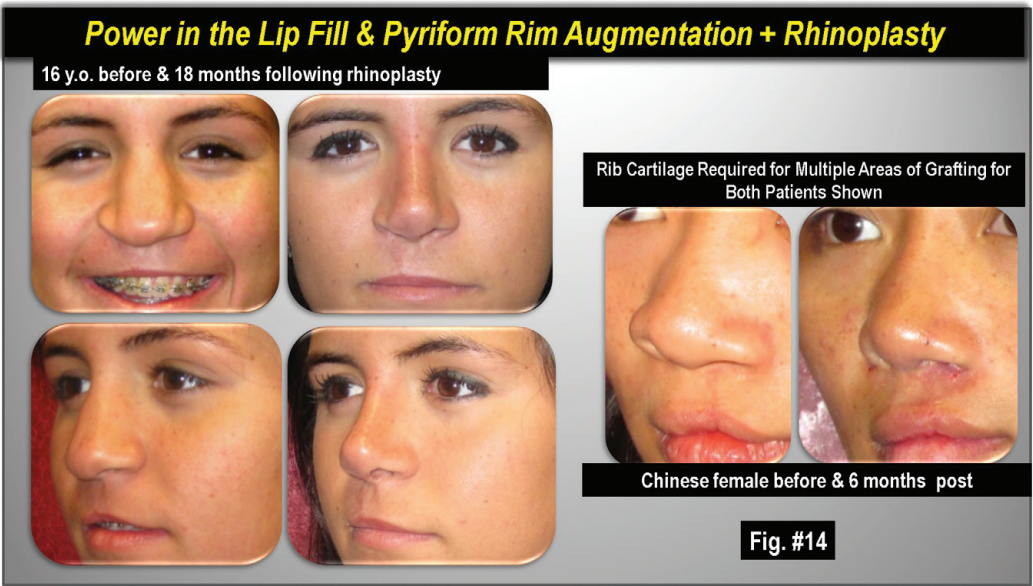


Figure 14.
Augmentation of the deficient pyriform rim as well the deficient lip and scar provides an excellent final refinement for the rhinoplasty procedure in the cleft lip patient.



Figure 15.
Skin grafting or composite grafting just inside the ala is occasionally required when enlargement of the nostril size is required to improve symmetry or to prevent nostril stenosis in restricted or previously operated cases.

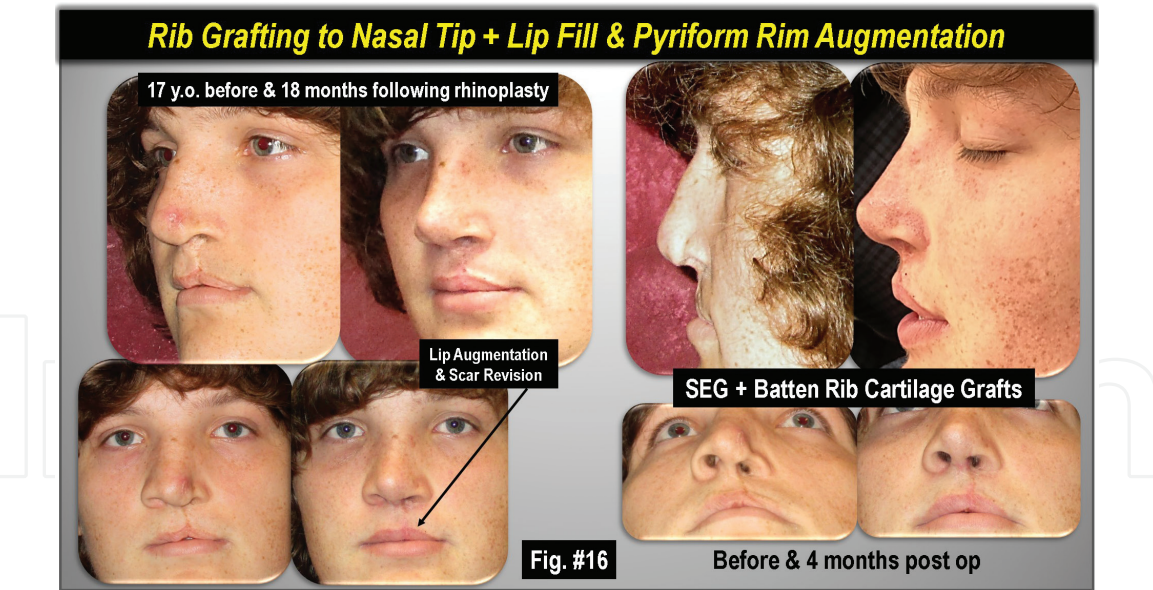


Figure 16.
Enhancing the appearance of a deficient lip or philtral ridge on the cleft side can greatly improve the overall results during rhinoplasty for the cleft lip and palate patient. The patient shown had augmentation to all the above areas in addition to the typical nasal cartilage grafting.

apply positive pressure to lungs. Any indication of lung perforation will need to be addressed immediately. Then, a collagen matrix can be placed to obliterate the dead space, along with layered suturing.

2.15 Lip and philtral ridge

Enhancing the appearance of a deficient lip or philtral ridge on the cleft side can greatly improve the overall results during rhinoplasty for the cleft lip and palate patient (**Figure 16**). Various fillers exist that can be used under a flat philtral ridge or atrophic portion of the lip. Also, fat grafting via newer micronized fat injection systems like ALMI® give the surgeon the ability to be much more precise with fat injections. The growth factors and pre adipocytes also may improve internal scar softness beyond that which can be done by a formal scar revision.

3. Conclusion

Key new points for technique:

- Septal extension grafts made from the interior of rib cartilage (**Figures 6 and 11**).
- Batten grafts from the curved portion of rib cartilage (**Figures 8 and 12**).
- Modified asymmetric lateral crural steal plus rib (**Figures 4 and 5**).
- Large fixated pyriform rim/premaxilla bone or cartilage grafting (**Figures 9 and 15**).

Even though cleft rhinoplasty is a complex surgical procedure, its results can be satisfying for the surgeon and life changing for the patients as it provides symmetry, improved esthetics and enhanced functionality, including better breathing. Its complexity originates from the need of multiple surgical stages over the years, which require a full surgical team from different specialties. Major cartilaginous

grafting is typically needed for definitive rhinoplasty to repair nasal tip projection and septal deviation. Rib cartilage grafts are better compared to other donor sites, due to its strength, large supply when needed, ease of shaping, and high resistance to scar contracture. Moreover, rib cartilage grafts for nasal tip repair, may also be used rather than piriform rim implants in cases of premaxilla and piriform rim deficiency which must be addressed for best results.

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